

Restoring a monument

The ASI is restoring the Ta Prohm Buddhist temple complex in Cambodia, which attracts hundreds of tourists every day.

BY T.S. SUBRAMANIAN RECENTLY IN SIEM REAP

Gigantic silk-cotton trees have taken over the entire complex, splitting the blocks of stones and uprooting the galleries, causeways, shrines, and so on. The corbelled roofs have caved in and the gopuras look pathetic with the stones dislodged.

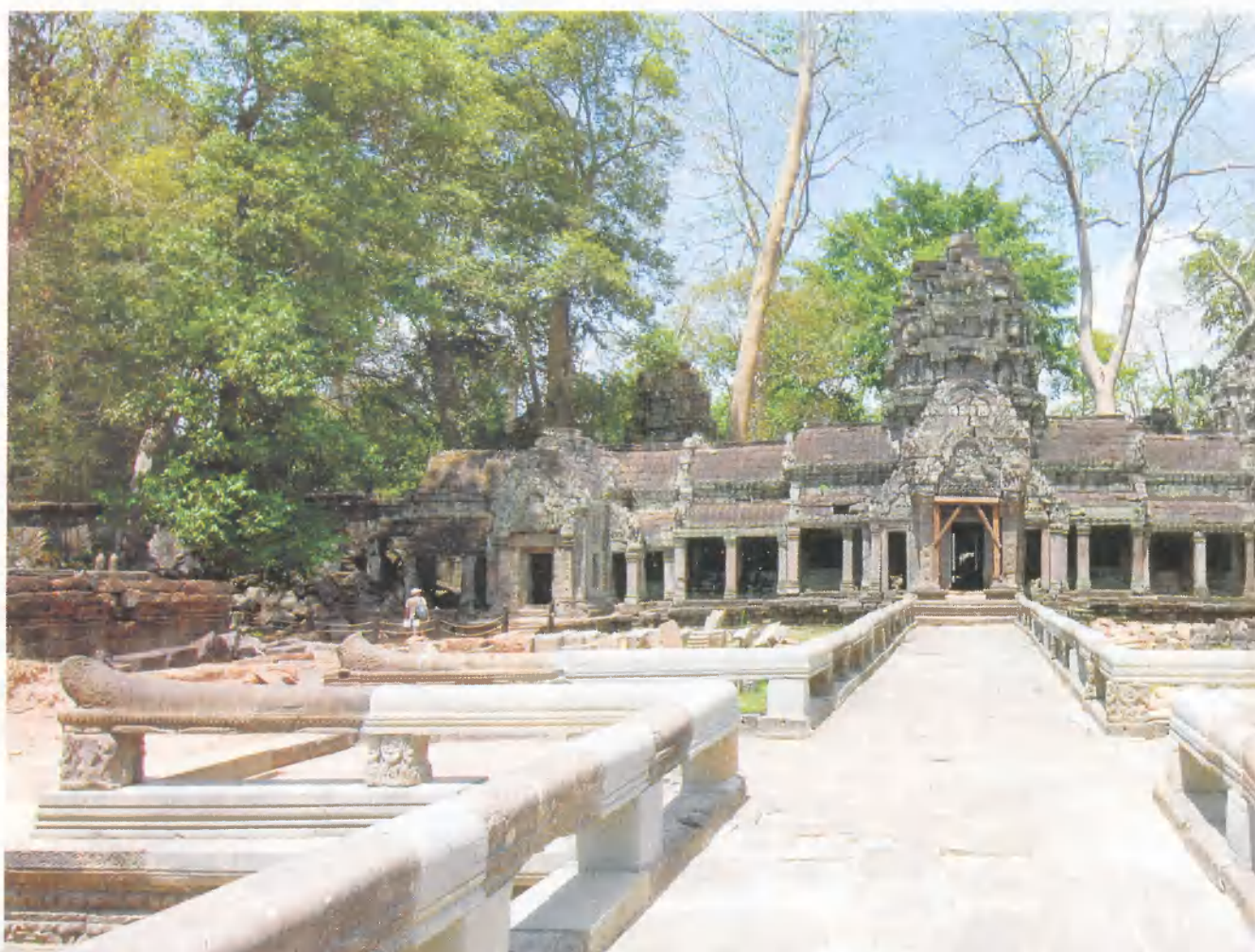
WHEN D.S. Sood stepped into the "Hall of Dancers" at Ta Prohm, the Buddhist monastic temple complex in Siem Reap province of Cambodia, in December 2004 he shuddered at the ruins he saw before him. Sood, a Deputy Superintending Archaeological Engineer with the Archaeological Survey of India (ASI), is a veteran of several challenging restoration projects in Sanchi, Khajuraho, Bhopal, Gwalior and Mandu in India, and at Angkor Wat in Cambodia itself. But the devastation that he saw in the Hall of Dancers and other structures in Ta Prohm complex was too much for him.

The Ta Prohm complex was built by the Khmer king Jayavarman VII circa 1181. Originally called "Rajavihara" (the royal temple), it comprised a sanctum sanctorum and 39 other shrines topped with *vimanas* (towers), galleries, causeways and entrance gate *gopuras*, among other structures. The king dedicated the complex to his mother, Rajachudamani.

CREEPERS ENTWINE THE silk-cotton tree to form a trellis over a shrine at Ta Prohm.









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**(CLOCKWISE
FROM TOP, left)**
The causeway in
the Ta Prohm
complex, before,
during and after
its restoration.



Siem Reap is the capital city of Siem Reap province in north-western Cambodia, and is the gateway to the Angkor region, which served as the seat of the Khmer empire.

The sanctum had an image of Pragnya Paramita, the goddess of wisdom, and it was installed in 1186 CE. The image was modelled on the king's mother. Two shrines in the third enclosure were dedicated to Jayavarman VII's guru and his brother. The Hall of Dancers was Ta Prohm's centrepiece, with 48 pillars supporting its corbelled roof. The pillars had exquisite carvings of dancing apsaras, elephants, men astride horses, floral motifs, and so on. Its walls had niches with friezes of Bodhisattvas and mythical animals.

"The Hall of Dancers was in total ruins. We had no access to it," Sood said, recalling his first foray into it. "The ceiling had completely collapsed and it was lying in pieces on the floor. Most of the pillars were broken in two or three pieces. The porches had caved in," he added. There was chaos, with architectural members, lintel beams and broken pillars lying all around. The entire structure was clogged with water and there was a few feet of silt. What was benumbing was that three monstrously tall silk-cotton trees [*Ceiba pentandra*] had grown inside the hall, dislodging its sandstone blocks, driving cracks in the wall and heaving up the floor. "The vegetation had penetrated the foundation and it was not safe for tourists to go inside," he said, as he displayed pictures of the ruins taken in 2004.

Cut to June 24, 2012. "This is our

RESTORATION WORK GOING on at the Hall of Dancers.





work yard,” Sood said softly and showed a group of visiting Indians how two broken pieces of a sandstone pillar with elegant carvings had been riveted together using steel pins by the ASI team led by him. The visiting Indian team was led by T. Satyamurthy, former Superintending Archaeologist, ASI. The air buzzed with the noise of small drilling machines boring holes into broken sandstone blocks. Some men were assiduously joining them together. The pillars were from the Hall of Dancers. They bore numbers: obviously Sood and his team had documented them, knowing where they would fit in. “If some pillars or architectural members are missing, we get the sandstone blocks from the original quarry in the Kulen mountains, about 35 km from here. In our restoration and conservation efforts, we have used only the original stones, and new stones only occasionally when it was totally necessary,” said T.K. Ganju, Senior Conservation Assistant, ASI.

“We are a team of five from the ASI,” said Sood.

Sood, Ganju, and E.P. Biswas and H. Raghavendra, both senior draftsmen of the ASI, led us inside the com-



THE HALL OF DANCERS before restoration work began. The ASI team found that the ceiling had completely collapsed, most of the pillars were broken in two or three pieces and the porches had caved in.

plex. There were stunning sights everywhere. A 30-metre-tall silk-cotton tree soared into the sky with its massive roots gripping a *vimana*. The roots had formed a trellis over the carvings above the shrine’s doorway. The *vimana* was in a precarious position, with the tree having dislodged its

sandstone blocks. In fact, 25 silk-cotton trees, each more than 200 years old and 30-40 metres tall, have taken over the entire complex, splitting the blocks of stones and uprooting the galleries, causeways, shrines, pillars, lintel beams, and many other structures. The corbelled roofs have caved in and



the entrance gate *gopuras* look pathetic with the stone blocks dislodged from their places.

Signs of vandalism are everywhere. Friezes of Bodhisattvas have been hacked away. Again, what would have been a series of bas-reliefs of beautiful Bodhisattvas on the wall of the gallery between the third and fourth enclosures have been chopped off.

Apart from trees and vandalism, frequent shifting of the capital, and invasions and internal strife played havoc with Ta Prohm, Bayon, Bantea Srei, Beng Mealea, Prasat Kravan and other temple complexes in the province. "When the capital was shifted from Siem Reap, this area was neglected and Ta Prohm fell into ruins. Many trees began to grow on its structures causing their collapse. That is why Ta Prohm is popularly called Tree Temple," Ganju said.

Right now, restoration is under way in the hall. A tower crane is being used to lift and put aside the fallen architectural members after they are numbered and measured in situ. The laterite apron along the plinth has already been exposed and strengthened. The joining of broken pillars or archi-

tectural members using threaded steel pins, epoxy and polymer is in progress. The transformation that the complex has been undergoing is unbelievable. Sood said: "Documents were prepared to find out where the stones belonged because entire structures had collapsed."

The ASI documented every stone member layer by layer and grid by grid; measured every sandstone block for its length, height and width; and recorded their quality and orientation. The entire hall was photographed bit by bit. Then the dismantling of the floor was done, the soil was treated appropriately and sandstone blocks of the floor and the plinth were reset. The original broken stones of the floors, columns and roof were repaired and joined with appropriate material and threaded with steel pins. It was ensured that all architectural members achieved the desired structural strength before they were reassembled.

Raghavendra and Biswas assiduously prepared documentation drawings of the plan, section and elevation of the hall. "Then we prepared conservation drawings wherein we num-



A SHRINE IN the firm "grip" of a silk-cotton tree.



THE ENTRANCE GOPURA, before (facing page) and after restoration.

bered each and every stone before the wall or roof was dismantled. All the scattered stones were numbered," Raghavendra said.

"We started our restoration work by the end of 2010. Our aim is to finish it by 2014," Sood said. "The restoration of the Hall of Dancers was the most challenging task not only because of its dilapidated state but because of the gigantic trees that were posing a threat to the structure. Besides, UNESCO decreed that the trees should not be cut because it wants visitors to see the contrast between the right side of the hall where the ASI would restore the roof and the left side where the trees would remain.

Despite its ruined state, Ta Prohm is the most visited temple complex in Siem Reap. It attracts hundreds of tourists every day from all over the world. Cameras click away endlessly as tourists pose for pictures. When the



THE RUINED STATE of the gallery located between the third and fourth enclosures before its restoration; (below) scaffolds erected for its restoration; and (right) after the restoration was completed in 2010.



branches of the trees sway, the structures also move, making the tourists gasp in astonishment. "Every day, from 9 a.m. there are long queues of tourists to look at the trees growing over the *vimanas*," Sood said.

Ta Prohm is concentric in plan. It has five rectangular enclosures and four entrances, one in each direction. It is 1,150 m long and 663 m wide. The entire complex, including the compound walls, the entrance *gopuras*, the 39 shrines, galleries, causeways, and so on, was built of sandstone blocks, with

the inner core made of laterite blocks. It was built in "Sarvato Bhadra" style, that is, it had access from the four directions. Galleries and entrances had corbelled, vaulted roof. As Michael Freeman and Claude Jacques, in their well-researched book entitled *Ancient Angkor*, explain, "...the device known as corbelling was sufficient and simple to execute with no need for scaffolding. Each higher stone course projects a little over the one below, until the sides finally meet at the top."

There is a long inscription in San-

skrit in Khmer script in the complex, which conveys that a township of 12,460 people flourished between the fourth and fifth enclosures. The complex had 19 Buddhist high priests. The inscription says it had 500 kilograms each of gold and silver, diamonds weighing 35 kg, and 4,600 pearls. When the ASI was restoring the Hall of Dancers in March this year, it found a beautiful golden crown under the floor. Sood argues that the Hall of Dancers itself "was not a hall for dancers but a place where the Buddhist



monks sat in meditation". Ta Prohm suffered desecration at the hands of Jayavarman VIII, who was a Hindu. During his reign, the carvings and sculptures of the Buddha, Avalokitesvara and others in the Buddhist pantheon were systematically hacked or destroyed in Ta Prohm, Bayon, Prea Khan, Bateay Kdei and other complexes.

Satyamurthy, who has restored scores of ruined monuments in India, described the complex as "an outstanding monument where there is

unique coexistence of trees and heritage". Ta Prohm was "different from the monuments in India because it has a single core", he said. The complex was built by piling stone blocks one upon the other. No mortar or binding material was used to cement them. So when the trees grew over the structures, the roots could not grow deep into the core of the structures because there was no masonry inside. Satyamurthy said: "The trees look like a mother embracing her child. The advantage is that they have not completely uproot-

ed the structures. The disadvantage is that if the single core is removed, then the entire structure will collapse."

UNESCO declared Angkor a World Heritage Site in December 1992, and Angkor Wat, Ta Prohm, Prea Khan, Bayon, Beng Mealea and other complexes were recognised as World Heritage Monuments. After an inter-governmental conference in Tokyo in 1993, an International Coordinating Committee (ICC) was established to oversee the restoration work at Angkor. The committee meets



ASHOK KRISHNASWAMY

DETAILS OF A torana in the Ta Prohm complex.

several times a year in plenary and technical sessions. On their part, the Khmers themselves have established a body, APSARA (Authority for the Protection of the Sites and Administration of the Region of Angkor).

The Government of India offered to restore and conserve the Ta Prohm complex with its own funds. That is how the ASI stepped into Ta Prohm in December 2004. A board in the complex says, "A partnership project of the Archaeological Survey of India with APSARA National Authority in cooperation with UNESCO...."

Sood said: "When we first came here, we analysed the temple, its structure and so on, and gave a report to the ASI. More than 65 per cent of the complex had collapsed. We studied the monuments [structures], their behaviour, tendency, stability, how they were built, the materials used in their construction, why the structures collapsed, what kind of conservation was needed, the quantum of restoration needed, etc. Generally, we preserve the monuments and give support to the structures. If some restoration is required, we do it. We want to conserve and restore. We do not want to add any thing new."

After analysing the entire monu-

ment, the ASI decided that it would restore five structures – the third enclosure gallery on the eastern side of the south wing; the causeway connecting the third and fourth enclosures on the west; part of the Hall of Dancers; the entrance *gopura* of the fourth enclosure on the western side; and the entrance gate *gopura* of the fifth enclosure on the west. Besides, nine critical

locations, where trees had grown on the roof of the structures, were identified for a support system. Nearly three years of extensive documentation, studies and analysis gave the ASI team a tremendous insight into how "to respect, conserve, and maintain the authenticity and integrity of the temple complex".

The restoration work proper began



FROM LEFT, D.S. Sood, the ASI team leader; T.K. Ganju, senior conservation assistant; and H. Raghavendra and E.P. Biswas, both senior draftsman, at the Ta Prohm complex.

in 2007, with about 200 Cambodian workers, including 20 skilled workers, assisting the ASI team. Since the restoration and conservation work is multidisciplinary in nature, the ASI took the help of the Forest Research Institute (FRI), Dehradun; Water and Power Consultancy Service Limited (WAPCOS), New Delhi; and the Indian Institute of Technology Madras. The FRI helped in conserving and maintaining the trees.

WAPCOS did hydrological, drainage and ground-penetrating radar studies to understand the movement of roots. IITM helped the ASI in understanding the complexities and resolving the issues of structural stability of the various parts of the monument, particularly where the trees were growing over the structures. Larsen & Toubro provided specialised scaffolding.

Juthika Patankar, now Additional Director-General, ASI, told the ICC technical session in June 2011: "...Trees have been retained at the site by providing steel tubular props; the material has been sensitive enough, not causing a single scratch to the physical fabric, thus ensuring that the interventions are completely reversible. Also crack metres and tilt metres have been installed at critical locations to check movement, if any, thereby ensuring constant monitoring."

GALLERY RESTORATION

The first structure that the ASI team restored was the third enclosure gallery. "It had collapsed completely," said Sood. The gallery was a long verandah-like structure, 41.15 m long and 4.85 m broad. It had two rows of sandstone columns [pillars] in front and a continuous wall in the rear, and a shrine in the centre. The gallery had corbelled roof, supported by the wall and the sandstone columns. The wall had niches with big carvings of apsaras, mythical animals, and so on. [The niches are barren now as the carvings were hacked off during the reign of Jayavarman VIII.]

When the ASI began its work, what remained of the gallery was a forlorn,



THE GOLDEN CROWN in situ, when it was discovered in the Hall of Dancers, and (below) after it was polished.



roofless verandah with the corbelled roof, broken pillars and a ruined shrine lying on the ground. The beautiful gallery had virtually become debris. The gallery's restoration work was completed in 2010. "A trial assembly was conducted before the actual reconstruction of the gallery on the site," Sood said.

The principle of anastylosis was adopted in the restoration work: original stones found at the location were used to the maximum extent and new stones were inserted only when absolutely necessary. Janhwi Sharma, Director (Conservation), ASI, told the ICC that only 5 per cent of new stones were added in the gallery and that it was done only where it was structurally necessary.

Sood said, "During the restoration, we used the same technology [used by Khmers]. We did not use any mortar or other binding material. We were very clear that we would not use broken stones without joining them. If a

stone was broken into several parts and all the broken parts were available, we joined them together. We joined the broken pieces by drilling and inserting steel pins inside."

The restoration of the causeway between the third and fourth enclosures was comparatively easy. The causeway is a broad footpath with a naga balustrade on either side (stone railing ending with a seven-headed serpent). The conservation work included treatment of the subsoil, resetting of the laterite base and core, and so on. The sandstone plinth and floor were re-assembled to their original alignment. "The naga balustrade has been restored by retaining the old stones wherever possible. Post-conservation drawings of the restored causeway have been prepared for comparative study," Biswas said.

Restoration of the entrance gate *gopuras* is under way. In these *gopuras*, the stones have been arranged in such a way that they resemble the visage of Avalokitesvara. But neglect led to these stones being dislodged from their positions. They have been readjusted and repositioned with the help of a chain pulley.

Satyamurthy praised the new techniques adopted by Sood and his men in restoring Ta Prohm. But Sood, without any trace of boasting, said, "This is easy [work] for us since I have been doing such work since 1975 at Mandu, Sanchi, Khajuraho and other places in India." □